

We Claim:

1. A hydrogen storage bed system including:
  - a pressure container;
  - a hydrogen storage alloy disposed within said pressure container; and
  - an integrated thermal management system integrally disposed within said pressure container including:
    - heat generation means;
    - cooling means, said cooling means adapted to use an aerosol coolant; and
    - heat distribution means.
2. The hydrogen storage bed system of claim 1, wherein said cooling means are adapted to use an air/water aerosol coolant.
3. The hydrogen storage bed system of claim 2, wherein said cooling means include a means to create said air/water aerosol.
4. The hydrogen storage bed system of claim 3, wherein said means to create said air/water aerosol include a nozzle or atomizer.
5. The hydrogen storage bed system of claim 1, wherein said heat generation means is selected from the group consisting of electrical heating elements and catalytic combustors.

6. The hydrogen storage bed system of claim 5, wherein said heat generation means is one or more catalytic combustors.
7. The hydrogen storage bed system of claim 6, wherein said catalytic combustors are designed to combust at least one fuel selected from the group consisting of hydrogen, gasoline, fuel oil, propane, diesel fuel, and natural gas.
8. The hydrogen storage bed system of claim 1, wherein said heat distribution means includes heat sinks thermally coupled to both said heat generation means and said cooling means.
9. The hydrogen storage bed system of claim 8, wherein said heat distribution means further includes heat distribution fins thermally coupled to said heat sinks and dispersed within said hydrogen storage alloy.
10. The hydrogen storage bed system of claim 9, wherein said heat distribution fins and said heat sinks are formed from a material selected from the group consisting of thermally conductive graphite, stainless steel, magnesium and magnesium alloys.
11. The hydrogen storage bed system of claim 1, wherein said heat distribution means includes heat pipes thermally coupled to both said heat generation means and said cooling means.

12. The hydrogen storage bed system of claim 11, wherein said heat distribution means further includes heat distribution fins thermally coupled to said heat pipes and dispersed within said hydrogen storage alloy.
13. The hydrogen storage bed system of claim 12, wherein said heat distribution fins are formed from a material selected from the group consisting of thermally conductive graphite, stainless steel, magnesium and magnesium alloys.
14. The hydrogen storage bed system of claim 1, wherein said hydrogen storage alloy is selected from the group consisting of Ti-Zr based alloys and Mg based alloys.
15. The hydrogen storage bed system of claim 1, wherein said system further comprises a hydrogen gas distribution system to enhance the speed of hydriding/dehydriding of said storage alloy.
16. The hydrogen storage bed system of claim 15, wherein said hydrogen gas distribution system includes a distribution manifold and one or more hydrogen permeable gas distribution tubes distributed throughout said hydrogen storage alloy.
17. The hydrogen storage bed system of claim 16, wherein said hydrogen gas distribution system further includes a recapture tank including a metal hydride for recapturing unadsorbed hydrogen.

18. The hydrogen storage bed system of claim 1, wherein said integrated thermal management system further comprises:

heat conducting projections extending and distributed within said pressure container in heat transfer contact with said hydrogen storage alloy; and

a heating/cooling sink positioned within said pressure container and connected in heat transfer relationship to said heat conducting projections and to said heat generation means and said cooling means;

whereby heat is transferred to said hydrogen storage alloy from said heat generation means and from said hydrogen storage alloy to said cooling means through said heat conducting projections and said heating/cooling sink.

19. The hydrogen storage bed system of claim 14, wherein said Mg based alloy has a composition of 95.6 wt.% Mg, 1.6 wt.% Ni, 0.8 wt.% Si and 2.0 wt% Mn.